3. Radar Climatology Analysis and Display

3.1 Introduction

Precipitation estimates produced by the WSR-88D precipitation processing system (PPS) are significantly affected by incomplete sampling of actual precipitation. The incomplete sampling is related to the sampling geometry of the hybrid scan used in the PPS and the actual vertical profile of reflectivity. The hybrid scan and occultation correction used in the preprocessing algorithm of the PPS is an attempt to mitigate the effect of terrain in the precipitation estimates such that higher tilts and/or an occultation correction are used in areas where digital terrain data indicates blockage. Using higher tilts for some azimuths means that the radar will be sampling the atmosphere at a much higher height than if a lower tilt had been available. This means that the radar will overshoot the precipitation at shorter ranges for those azimuths which use a higher tilt. The occultation correction of radials which are partially blocked is an attempt to use the lower tilt for better range performance by adding a predefined correction factor to the reflectivity hybrid scan beyond the partial blockage. Unfortunately, in many cases the occultation correction is to little or too much. Additionally, partial and total beam occultations not resolved in the terrain data also affect the precipitation estimates for many radars in the United States.

3.2 Climatological Analysis

A climatological analysis of precipitation estimates produced by a given radar can be useful in defining areas which are significantly affected by incomplete sampling of actual precipitation. A precipitation climatology derived from radar is a mixture of "real" rainfall climatology, and "artifacts" caused by beam geometry interacting with the mean vertical profile of reflectivity present during the period of analysis.

A software package which allows users to produce and analyze radar climatologies has been developed by the NWS Hydrology Laboratory. The Radar Climatology (RADCLIM) analysis and display software allows users to create climatologies based on an archive of hourly Digital Precipitation Arrays (DPAs) for any radar site in the United States. The software also allows users to display and compare hybrid scan and occultation data to the DPA climatology. RADCLIM can also be used to specify upper and lower data thresholds to be applied to the climatology to help define an "actual" radar coverage area for precipitation estimation. An option to re-map the hybrid scan and occultation data from native polar coordinates to the HRAP grid allows a more direct comparison to DPA climatologies which are computed on the HRAP grid. A users guide and software documentation for the RADCLIM software is included in the appendix. Instructions for downloading and installing the software are included in this documentation. Instructions for downloading and processing DPA files from the Hydrology Laboratory web site are also included in the documentation.

3.3 Climatological Analysis for Blacksburg, Virginia (KFCX)

A climatological analysis of DPAs during the warm season (April - September) for

Blacksburg VA is shown in figure 1. Areas of lower precipitation frequency at long ranges and in a wedge shaped area north of the radar are areas where the radar hybrid scan is climatologically sampling above or in the upper reaches of the mean vertical profile of reflectivity during the warm season. The hybrid scan used to create the DPA product is shown in figure 2. Note that the radials where the 2nd elevation angle was used correspond to the wedge of lower frequencies shown in figure 1. The occultation data for the 1st tilt used in creating the DPA products is shown in figure 4. Note that there are several radials where an occultation correction was applied. The effect of under / over correction can also be observed in the climatology shown in figure 1. For example, it appears that the wedge to the north of the radar observed in the climatology is wider than one would expect if the hybrid scan were the only consideration. It appears that partial beam occultation correction did not completely account for the partial beam occultation which can be observed in lowered frequencies in some areas. A radar map showing the “effective” radar coverage is shown in figure 4. The radar coverage map was created by applying a lower threshold to the radar climatology below which the radar can not generally be trusted for precipitation estimation.

3.4 Climatological Analysis for Jackson, Mississippi (KJAN)

A climatological analysis of the mean rainfall rate derived from the Jackson Mississippi Radar site in the warm season is shown in figure 5. The reduction in mean rainfall rate in a wedge east of the radar is apparent in the image and is due to tall pine trees on a small ridge east of the radar. The hybrid scan shown in figure 6 indicates that the lowest tilt was used in the area of reduced rainfall rates. The occultation correction map shown in figure 7 indicates that there was no occultation correction applied in the area of reduced rainfall rates.

3.5 Climatological Analysis for Tallahassee, Florida (KTLH)

A climatological analysis of the mean hourly precipitation rate derived from the Tallahassee, Florida Radar site in the warm season is shown in figure 8. The reduction in mean rainfall rate to the north east of the radar is apparent in the image and is due to tall pine trees located near the radar. The smaller wedge of smaller mean rainfall rates to the north east of the radar site is caused by the state capitol building located in down town Tallahassee. Figures 9 and 10 indicate the lowest tilt was used in the area of reduced mean rainfall rates and that there was no occultation correction applied.

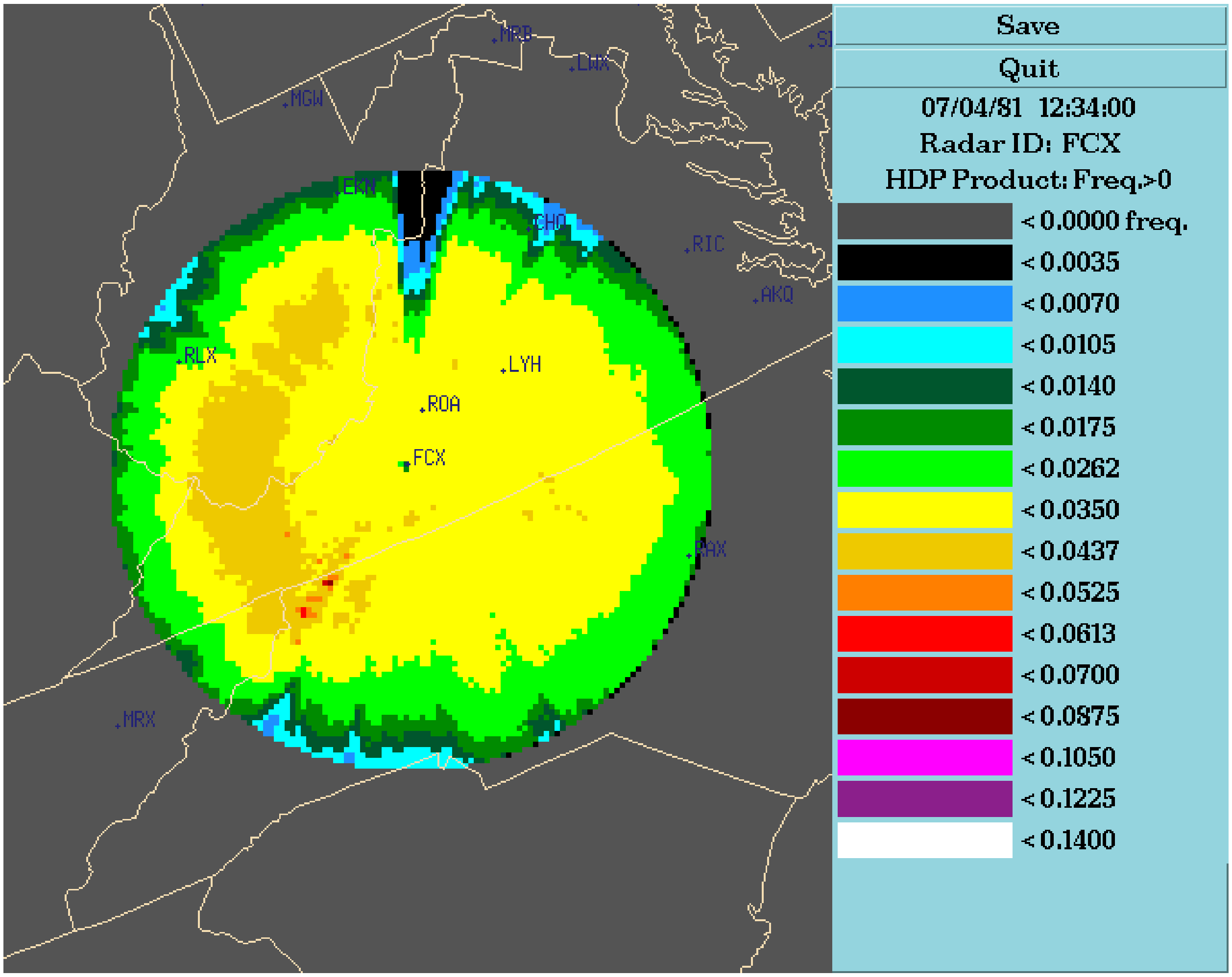

Figure 1. Frequency of rainfall (KFCX)

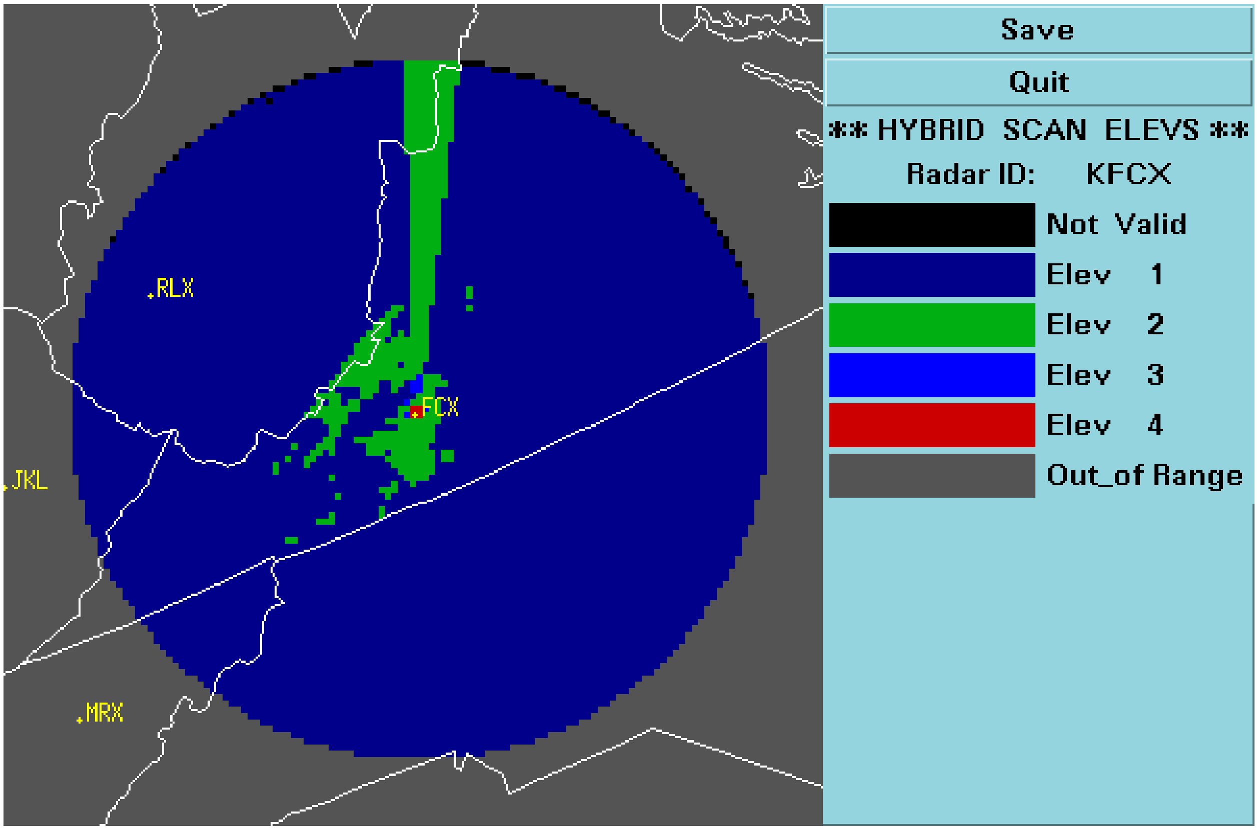

Figure 2. Hybrid Scan (FCX)

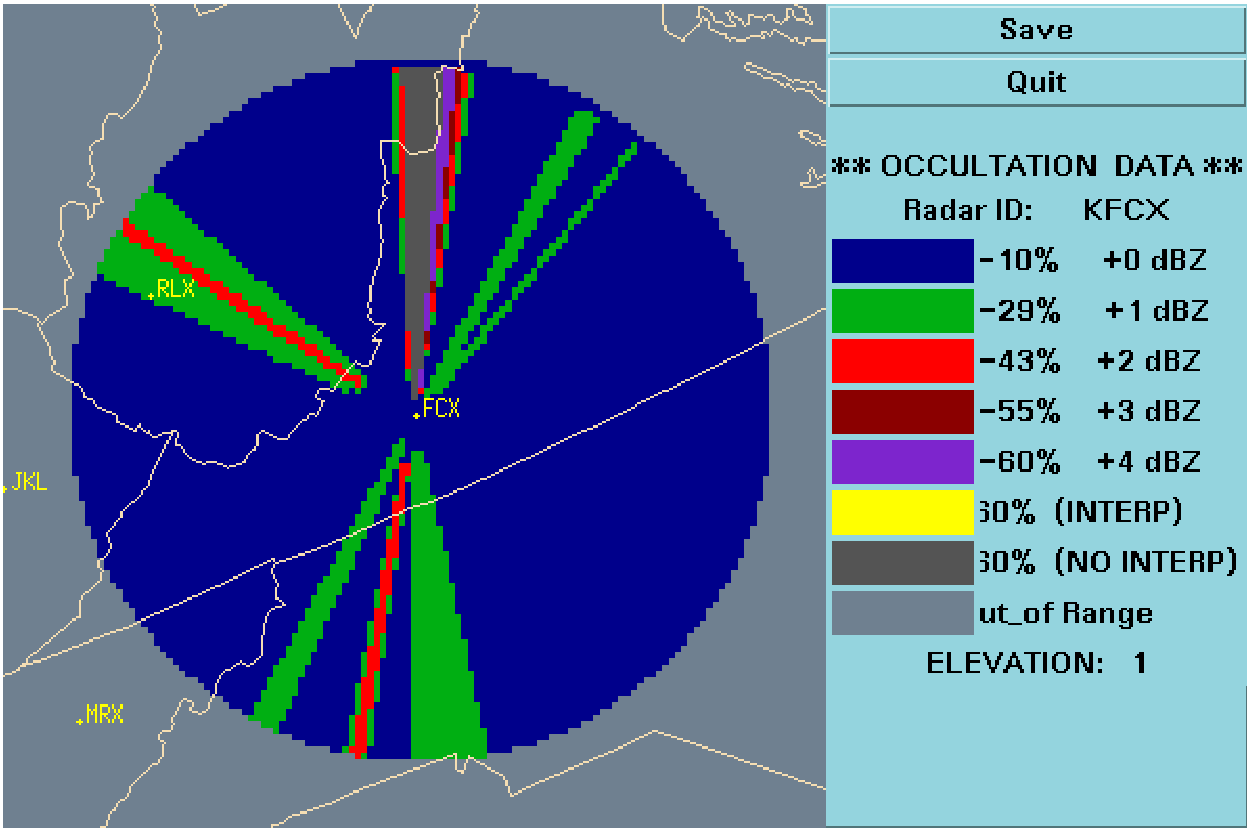

Figure 3. Occultation correction for first tilt (KFCX)

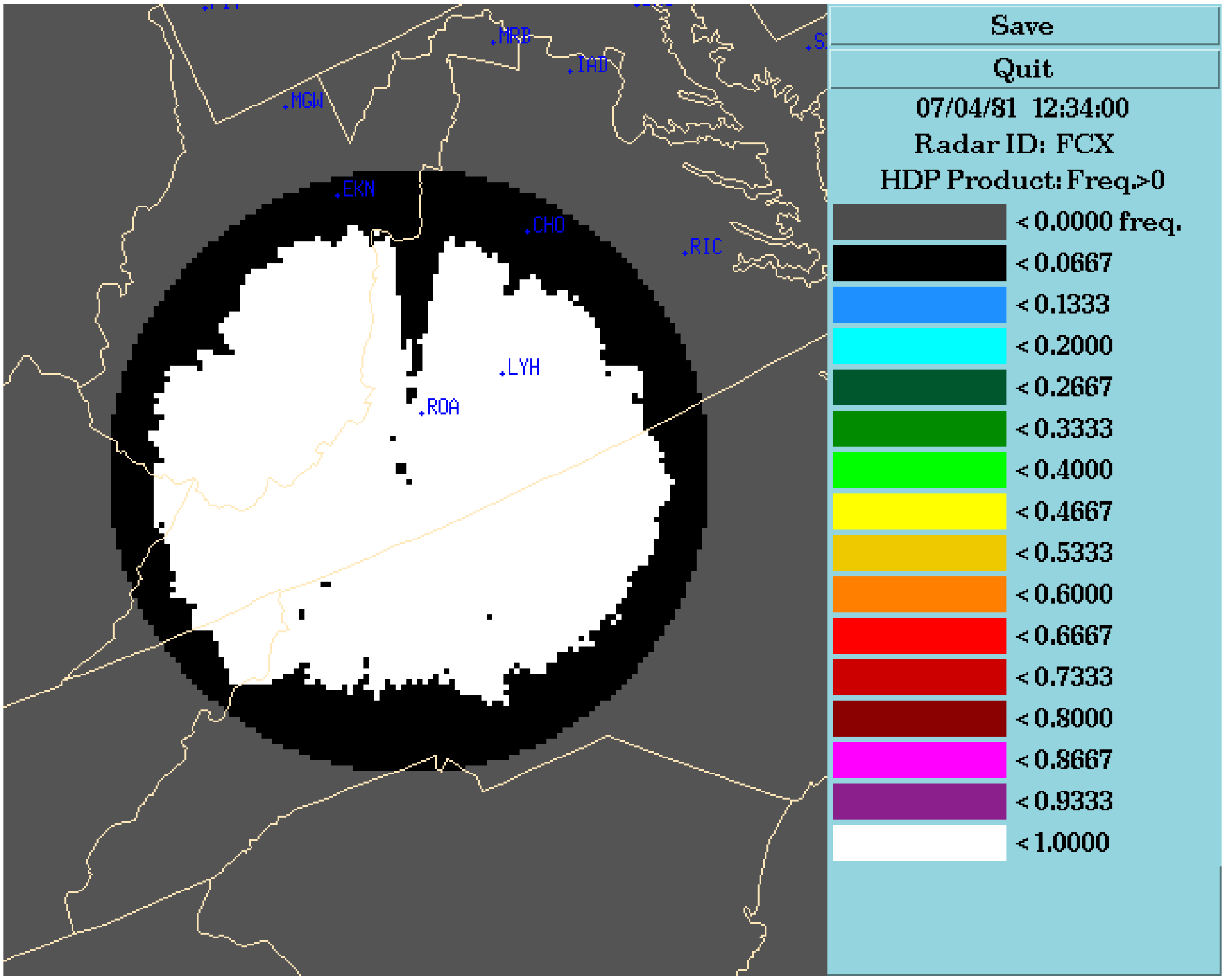

Figure 4. Radar Coverage Map (KFCX)

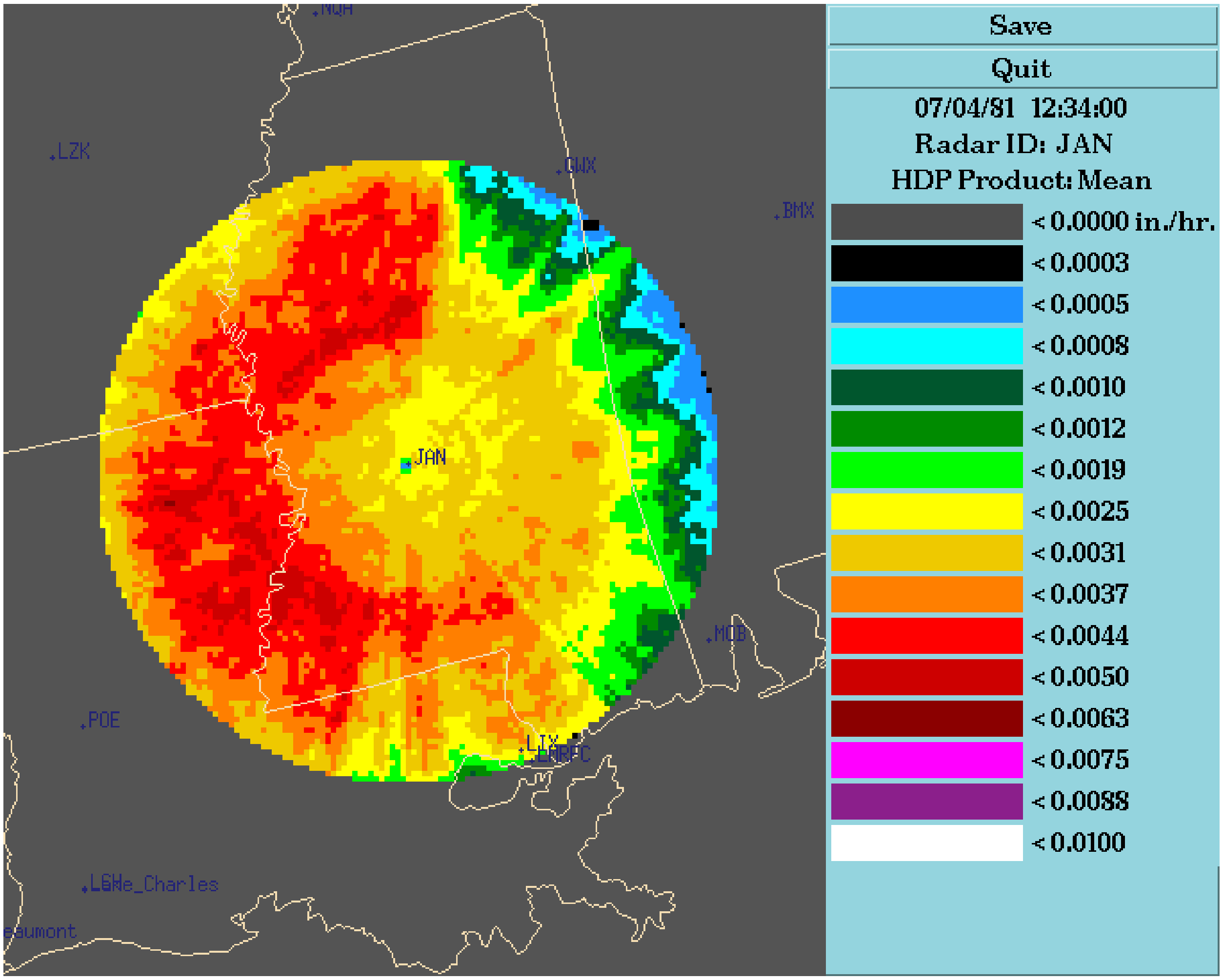

Figure 5. Mean hourly rainfall rate (KJAN)

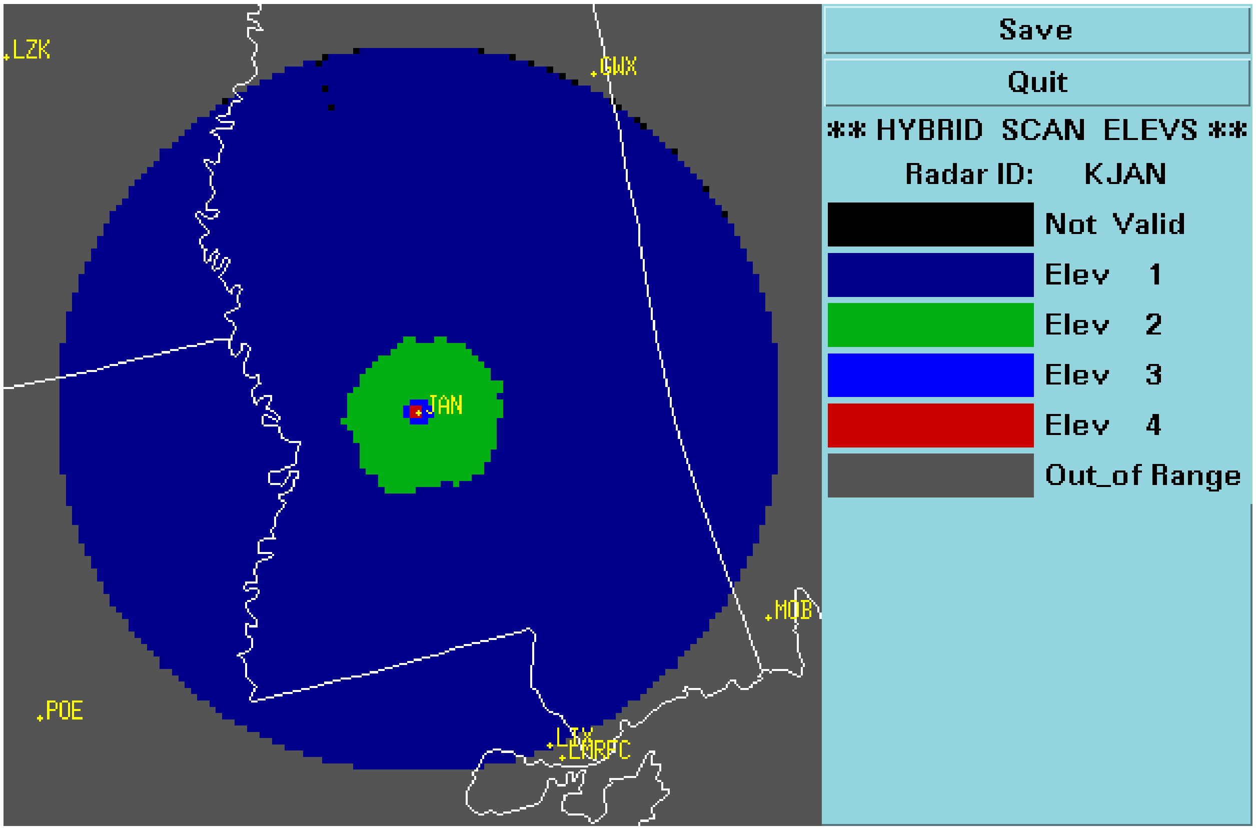

Figure 6. Hybrid Scan (KJAN)

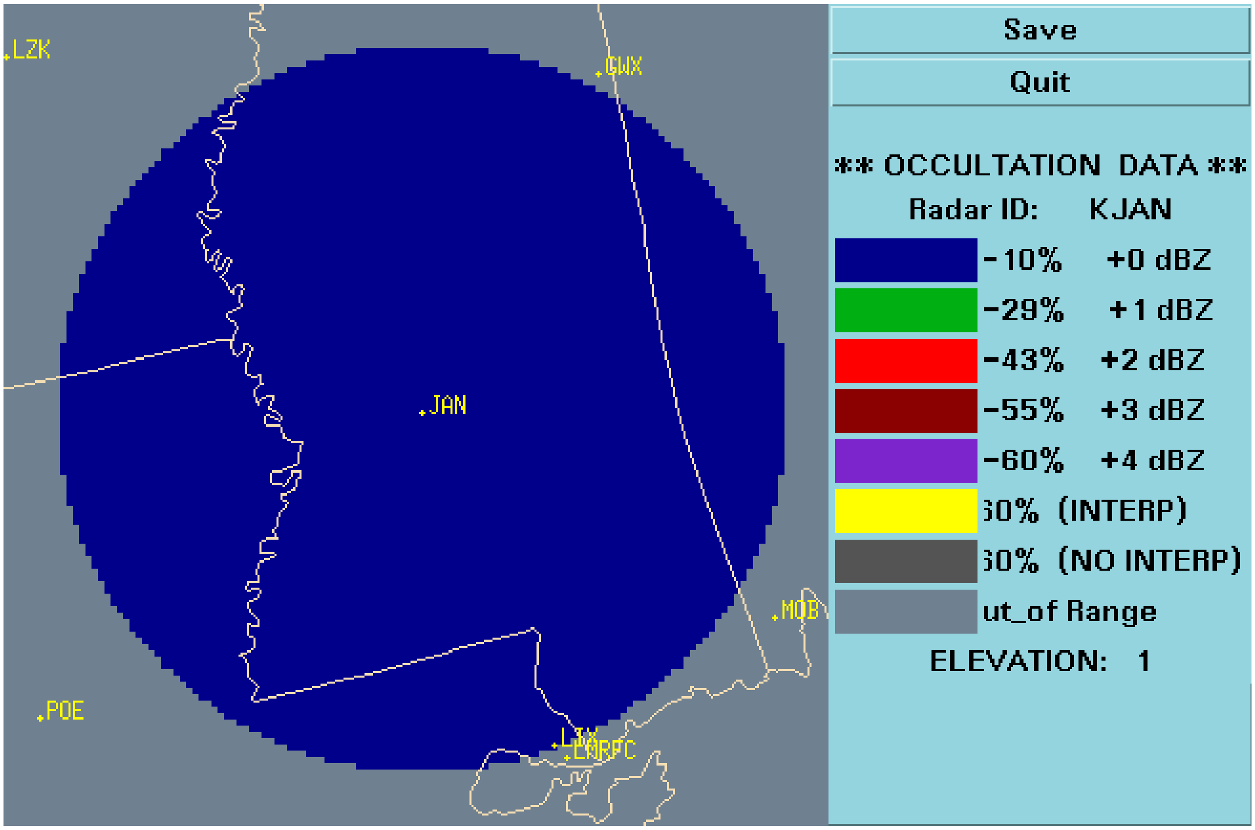

Figure 7. Occultation correction for first tilt (KJAN)

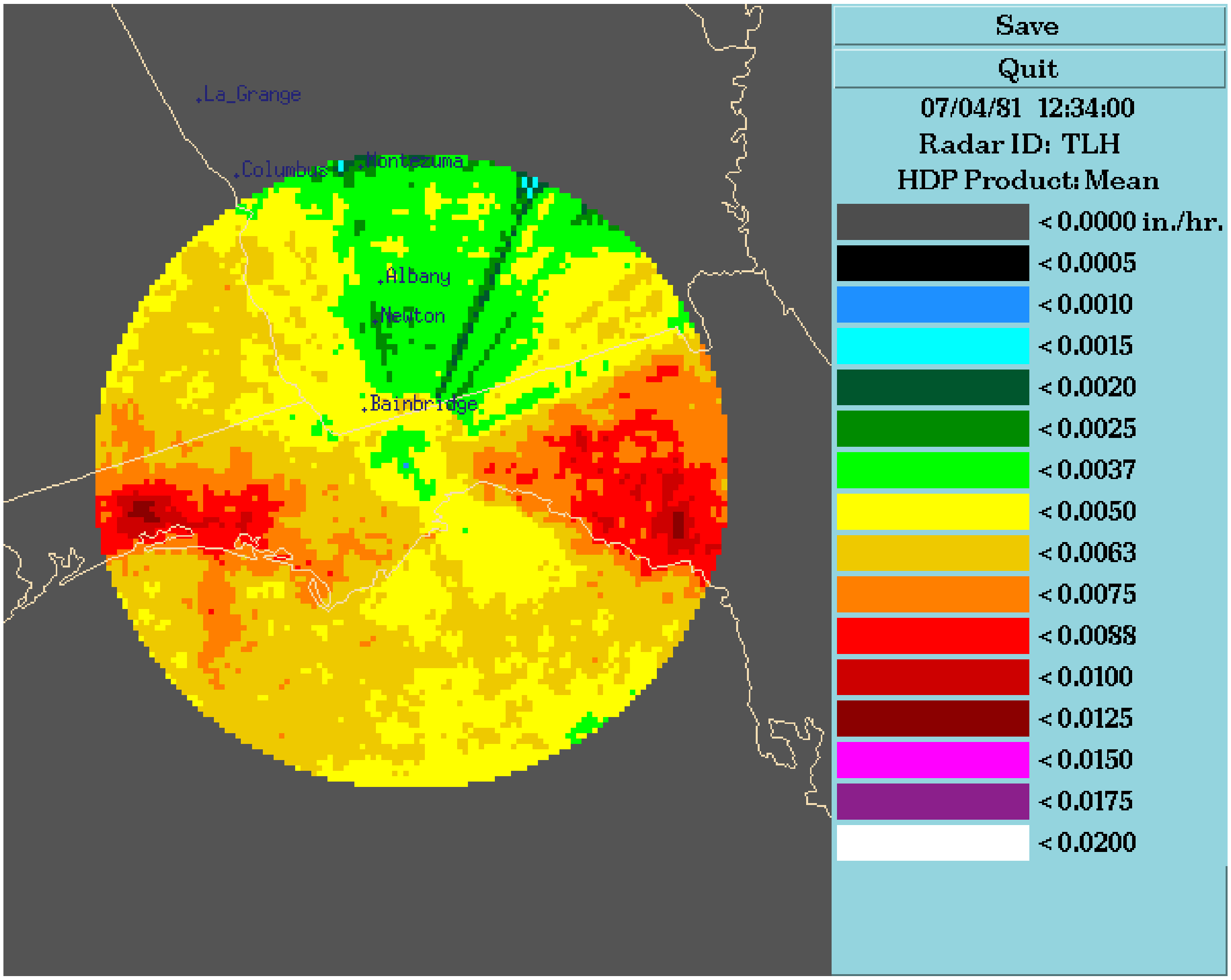

Figure 8. Mean hourly rainfall rate (KTLH)

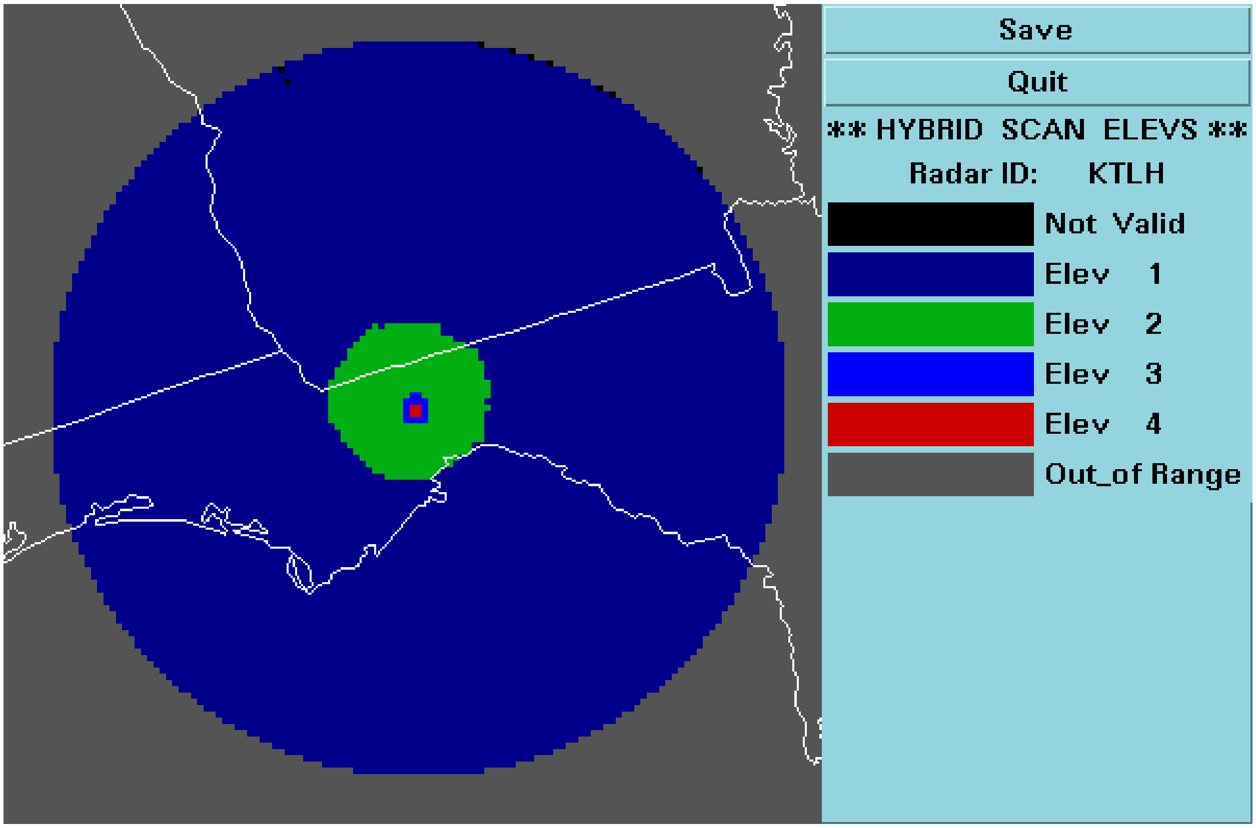

Figure 9. Hybrid Scan (KTLH)

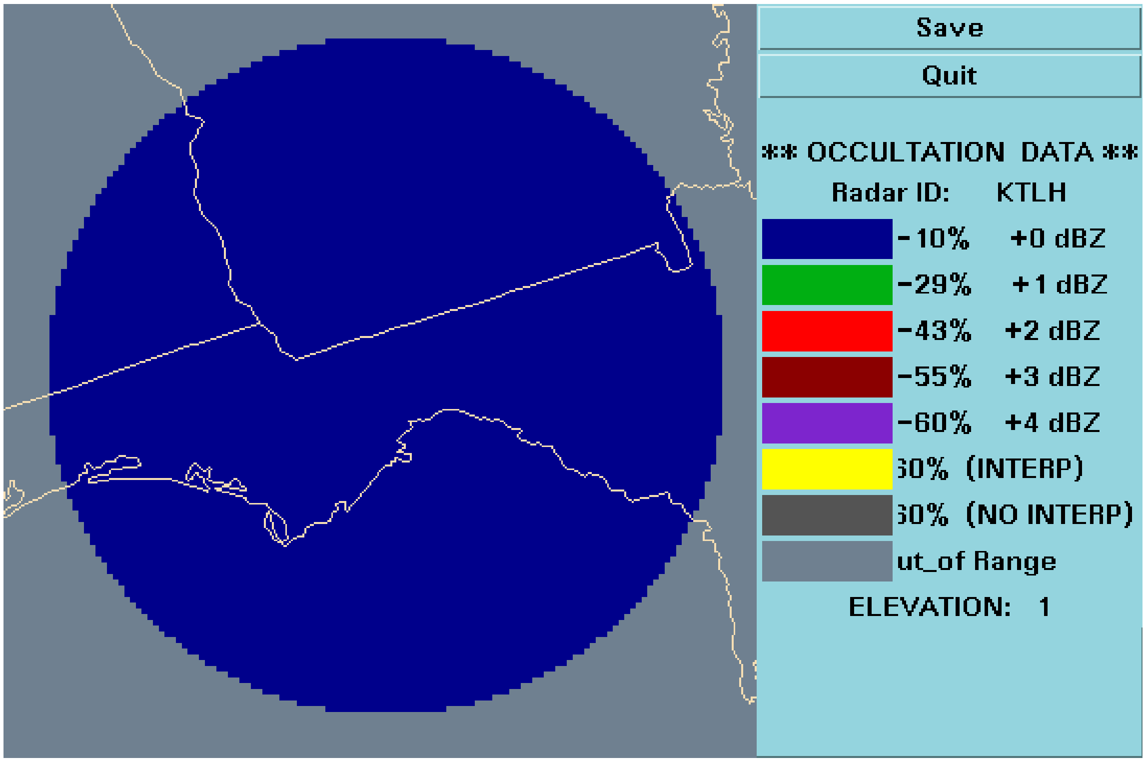

Figure 10. Occultation correction for first tilt (KTLH)